Loureiro Engineering Associates, Inc.

October 19, 2001

United States Environmental Protection Agency
New England
One Congress Street
Suite 1100 (HBT)
Boston, MA 02114-2023

Attn.: Mr. Juan A. Perez
Ms. Kim Tisa

RE: Remedial Action Work Plan
Willow Brook and Willow Brook Pond
Response to August 10, 2001 EPA Comments

Dear Mr. Perez and Ms. Tisa:

We have prepared this letter on behalf of our client, United Technologies Corporation, Pratt & Whitney Division (UTC/P&W), to provide responses to each of the comments raised by the United States Environmental Protection Agency (US EPA) in an August 10, 2001 memorandum with regard to the following documents:

- *Remedial Action Work Plan, November 2000, Revised May 2001 (RAWP)*
- *May 31, 2001 Response to March 21, 2001 EPA Comments*
- *May 31, 2001 Response to May 18, 2001 DEP Comments*
- *June 21, 2001 Response to June 8, 2001 DEP Comments*
- *July 13, 2001 Response to July 6, 2001 DEP Comments w/ attachments*
- *July 26, 2001 Response to DEP Comments w/o attachments*
- *Dust Control Plan, May 2001*

This letter is formatted to provide each of the comments followed by the response to the comment in italics. Submitted with this letter is one copy of the Remedial Action Work Plan that has been revised in accordance with the responses provided. This copy of the Remedial Action Work Plan also incorporates all revisions made as a result of previous comments from the United States Environmental Protection Agency and the Connecticut Department of Environmental Protection.

1. Page 17, 3rd complete paragraph, last sentence - For clarification, §761.79(c) contains no provisions for decontamination of water; the correct citation is §761.79(b).

The RAWP has been revised to reflect the correct citation.

2. Page 18, **Former Oil/Water Separator**, 2nd paragraph - A description of the additional soil sample collection procedure to be used prior to implementing remediation of this

area should be described here.

Since this additional characterization has already been completed (performed July 25, 2001), no revisions to the RAWP have been incorporated. These subsurface investigations were performed in accordance with standard operating procedures consistent with all of the previous investigations performed by Loureiro Engineering Associates, Inc. for this project. Specifically, SOP ID 10006 Soil Sampling, SOP ID 10011 Geoprobe Probing and Sampling, and SOP ID 10015 Geologic Logging of Unconsolidated Sedimentary Materials represent the procedures implemented for the additional investigation. Copies of these SOPs are included as Attachment No. 1 for reference.

3. Page 22, **Site Restoration** - The 2nd sentence states "The restoration of the waterway and wetland were previously described." A reference should be provided here.

The RAWP has been revised to identify that the description is presented in the previous section.

4. Page 29, **Confirmatory Soil Sampling for Constituents Other than PCBs,** 3rd paragraph – The text indicates that if areas exceed the criteria for COCs other than PCBs, those areas will be excavated and then used to backfill the PCB excavation. It is unclear if this is allowed under either the federal or state requirements. I recommend that we clarify that this is acceptable to CTDEP.

Consolidation of contaminated materials (non-RCRA) to one contiguous location at the subject site upon which an engineered control (capping) or building is constructed is a common practice in the state of Connecticut. Consolidation with capping is specifically allowed through the variance provisions of 22a-133k-2(f). A request for a variance has been submitted to the DEP and approval has been received.

5. Pages 29-30, **Sample Collection** - The text describes the SOP for sample collection and compositing. In EPA's March 2001 letter to P&W, I had recommended that compositing be done in the laboratory due to sampling concerns. P&W indicated in its May 31, 2001 response to EPA that it preferred field compositing and proposed an additional step for sample collection. I am not convinced that this step will provide sound representative samples for purposes of compositing. P&W argues that, due to the proximity of each grab sample to the other, the variability of moisture content will be minimal. This may or may not be true. However, if this is the procedure P&W wishes to implement in the field, I suggest that an additional step be added to the procedure; specifically that prior to compositing, discrete grab samples be allowed to "rest" so that any free water can be allowed to separate (and decanted) prior to compositing. To expedite sample collection, dedicated syringes would have to be used for each sampling location; however, EPA also does not recommend that the same syringe be used for the individual grab samples as proposed in the RAWP. Prior to finalizing its composite sampling scheme, EPA encourages P&W to coordinate these activities with its selected laboratory to insure that sufficient sample volumes will be collected for all COCs.

The remediation areas will be actively dewatered during performance of the confirmatory *sampling activities. Consequently, we do not expect free draining water to be present in any of the samples, when obtained. However, the RAWP has been revised to include a "resting period" to facilitate free water separation (and decanting) prior to compositing when the discrete grab samples are identified by the qualified field technician to contain excess soil moisture which will separate from the soil/sediment sample during a resting period. This procedure is detailed in SOP ID 10006W, which is included in Appendix B of the revised RAWP. Similarly, the Sample Collection discussion located in Section 4.2.2, Post-Excavation Confirmatory Sampling, of the RAWP has been revised to reflect this provision.*

In such cases that the above sample resting is necessary, dedicated syringes will be used. However, we see no justification for using separate syringes for the collection of aliquot samples that are to comprise a single composite sample. The RAWP has been revised to clarify the use of a single syringe for collection of aliquot samples that are to comprise a single composite sample unless the syringe is broken, clogged or otherwise inoperable, in which case it would be replaced.

The contracted laboratory is fully aware of the sampling procedures and the field technicians responsible for sampling are similarly familiar with the laboratory's sample volume needs. We appreciate this point.

6. Page 30, last paragraph - The text states that a visual characterization will be performed on each confirmatory sample. For clarification, visual observations should be made at each sampling location. In the event that visible staining or discoloration is noted, a bias sample should be collected rather than a 4-point composite sample.

The RAWP has been revised to clarify that the visual characterization referenced in this particular paragraph refers to a soil/sediment description including color, grain-size distribution, moisture, by a visual observation/manual manipulation method. These observations will be made at each sample location. As defined in Section 4.2.2 of the RAWP, judgmental sample locations (those deemed necessary due to soil discoloration or other uniquely suspicious feature, a.k.a. bias samples), will be added to the grid as appropriate based on in-situ soil observations.

7. Page 31, **Disposal Characterization Sampling**, 2nd paragraph - The text refers to PCBs at > 50ppm as "PCB remediation waste" and to PCBs at < 50ppm as "PCB-contaminated waste". It was EPA's understanding that all PCB-impacted materials were "PCB remediation waste" as defined at §761.3 and therefore is regulated under the federal TSCA PCB regulations. P&W has provided no documentation to support otherwise.

The RAWP has been revised to define both waste streams as PCB remediation waste (TSCA regulated materials). The > 50 ppm PCB waste stream will be disposed of at a Subtitle C, Hazardous Waste Landfill permitted for TSCA waste, while the < 50 ppm PCB waste stream will be disposed of at a New York State Department of Environmental Conservation (NYSDEC) permitted Subtitle D landfill under a project-specific approval issued by NYSDEC.

8. Page 31, **Miscellaneous Sampling** - It appears that P&W is proposing to characterize

debris generated from demolition activities after demolition has occurred. In the event that any of these materials have been in contact with PCB-containing material, characterization must occur prior to demolition, not after. The requirement to dispose of PCB contaminated wastes based on the "as-found" criteria applies to all PCB-impacted materials, not just soils and sediments.

The RAWP has been revised to clarify that where physically possible; debris will be characterized based on its as-found, pre-demolition PCB concentrations. Certain components of the subject structures may be impractical to sample in place, i.e. floor and/or sump slabs. These structures will be made accessible and sampled as appropriate to represent an as-found condition or disposed of as a > 50 ppm PCB waste stream.

9. Page 34, Section 4.5.1, **Disposable Equipment and Debris** - As stated in Comment 7, it is EPA's understanding that all PCB-impacted material is "PCB remediation waste". Therefore, to indicate that wastes will be disposed of as bulk PCB remediation waste is not clear since various disposal options exist based on the PCB concentrations. As such, please clarify P&W's proposed disposition of all waste streams that will be generated. (e.g. specify the proposed disposal facility for various waste streams).

The RAWP has been revised to specifically define the disposal disposition for all of the waste-streams expected from this project for clarification. A table summarizing our approach is presented in the section titled "Off-Site Disposal", located in Section 2.3.3 of the RAWP. The remainder of the RAWP has been edited to reflect this clarification.

10. Page 34, Section 4.5.2, **Decontamination Rinsate** - Unless P&W proposes to sample each rinsate waste prior to treatment, an assumption that the rinsate is < 50 ppm, as indicated in the text, cannot be made.

The RAWP has been revised to eliminate the reference to < 50 ppm PCBs in this section.

11. Page 38, Section 5.1.5, **Disposal Characterization Sampling, Data Type** - This paragraph is confusing. It appears that the only data that will generated for disposal characterization is IA data. As stated in previous correspondence, this is not acceptable. Please clarify this paragraph.

The RAWP has been revised to clarify that post-excavation disposal characterization sampling may include additional immunoassay field tests and/or laboratory analysis as acceptable to the disposal vendor and as a supplement to actual laboratory analytical data. Additional in-situ sampling and laboratory analysis will and has been implemented to provide additional characterization data of the various waste streams on an as-needed basis. As noted in Section 4.2.3, disposal characterization, evaluations will be based on as-found PCB concentrations unless the additional analysis is more restrictive.

12. Page 39, Section 5.1.6, **Miscellaneous Sampling** - P&W should include disposal "in-situ" characterization for other materials, including the concrete, if applicable.

Since the oil water separator and many miscellaneous underground utilities in the vicinity will be disposed of as >50 ppm PCB remediation waste, no additional characterization sampling will be necessary for those components. Structures and utilities associated with the process water facility will be sampled to determine the final disposal disposition. Where physically possible; debris will be characterized based on its as-found, pre-demolition PCB concentrations. Certain components of the subject structures may be impractical to sample in place, i.e. floor and/or sump slabs. These structures will be made accessible and sampled as appropriate to represent an as-found condition. The RAWP has been revised to clarify this point.

13. Pages 40-43, **Project Organization and Responsibilities** - A organizational chart should be included and identify the key personnel by name, their affiliation, and telephone #.

The RAWP has been revised to include a project contact list with applicable project titles.

14. Page 48, **Analytical Procedures, Section 5.7.2** - TAT of 2 weeks established for effluent samples may be too long. P&W should confirm that laboratory will be willing to meet 24-hr TAT as needed.

Turnaround times will be arranged as appropriate to accommodate the remedial activities. The contracted laboratory will be able to meet a 24-hour TAT for PCBs and will be directed to do so when necessary.

15. Inconsistencies are noted throughout this submittal. P&W should review and revise to insure consistency throughout. The following inconsistencies were noted:

a) Page 37 indicates that a Tier II data validation will be performed on the confirmatory data; Page 50, Section 5.8.4 indicates that 5% of the final data reports will be reviewed; Page 57 indicates that 20% of the data will undergo full data validation.

A Tier II validation will be performed on 100% of the confirmatory data as stated in section 5.1.4 (page 37). The text as referenced on page 50, section 5.8.4 titled "Laboratory Data Review" refers specifically to the internal laboratory data review process and is entirely independent of the Tier II validation. The text on page 50 has been revised to specifically detail the laboratory data review process of the contracted laboratory. The text on page 57 has been revised to indicate that 100% of confirmatory data will undergo Tier II validation.

b) Page 31 states that Method 8082A will be used for PCB analysis; Table 4-1 indicates Method 8082. Further P&W's May 31, 2001 Response to EPA's March comments also indicate Method 8082 will be used.

The RAWP has been revised to clarify that Method 8082 will be used for PCB analyses.

c) Page 28 states that 133 samples will be collected for PCB analysis; Table 4-1 indicates 121 samples will be collected; Table 4-2 indicates 117 samples for PCBs.

The RAWP has been revised to address EPA comment 31 and no longer states the number of PCB samples that will be collected in the referenced paragraph. Tables 4-1 and 4-2 have been *revised and are based on the proposed sample grid protocol. Both tables have been revised to state that 108 PCB confirmatory samples will be collected. However, the point of focus should be the grid pattern and related sample density rather than the theoretical number of samples projected, as actual field conditions will certainly command modifications to the theoretical layout. In addition, when/if exceedances of the applicable criteria are encountered, the final sampling density in these areas will typically increase well beyond that shown theoretically to appropriately demonstrate the success of the subsequent excavation.*

d) Page 35 indicates that *aqueous* PE samples will be collected for each suite of analytes; Page 53 indicates that four PE *soil* samples will be submitted. P&W's May 31, 2001 response also indicates aqueous PE samples will be used rather than soil.

The RAWP has been revised to clearly indicate that aqueous PE samples will be submitted for this project. The statement on page 53 has been revised to refer the reader to Table 4-2 for an estimated number of aqueous PE samples to be collected for this project.

e) Table 4-1 shows 69 composite samples will be collected for PCB; Notes 3 and 4 indicate 68 samples.

The number of PCB samples to be collected as stated in Table 4-1 changed from 69 composite samples in the May 2001 revision to the RAWP to 50 samples in the July 2001 revision. The notes have been revised to reflect the number of samples as stated in the July 2001 revision.

16. Page 51, Section 5.9.5, **Field Duplicates** - Text states "Field duplicates will be prepared as discussed in the FSP." EPA can find no procedure describing sampling procedures for field duplicates.

*Field duplicate sampling is presented in Section 4.6.2 **QA/QC Sample Collection, Duplicate Samples**. The verbiage of Section 5.9.5, as referenced above, has been revised to reflect this reference.*

17. Page 52, Section 5.9.8, **Matrix Spike/Matrix Spike Duplicates** - For clarification, MS/MSDs can be used to measure both precision and accuracy, not just accuracy.

This point is acknowledged.

18. Page 51, Section 5.9.5, **Field Duplicates** - The text states "Acceptable duplicate precision for soil samples must be less than 50%". EPA assumes that P&W means that the "RPD must be less than 50%" rather than the precision. Please clarify.

EPA's assumption is correct since the relative percent difference is a measure of precision. The RAWP has been revised to clarify that the RPD must be less than 50%.

19. Table 4-1, **Extraction Method Summary** - Various extraction procedures are included for the analytes of interest. Please clarify when/what criteria will determine the extraction method that will be employed for this project.

Extraction procedures for each matrix will be employed as recommended in the applicable analytical method. Table 4-1 in the RAWP has been revised to include the specific extraction methods that will be used for each analytical method and each matrix.

20. Table 4-1, **Extraction Method Summary** - Only soil/sediment matrices are shown. Please revise to include other matrices that will be analyzed during this project, including water and concrete.

Refer to comment 19 response.

21. Having three (3) tables labeled 4-1 is confusing. It would be helpful if the tables were renumbered in some fashion since these are separate tables.

Tables 4-1 in the RAWP have been renumbered to reflect each one as a separate table (table 4-1, 4-2 and 4-3). Tables originally numbered 4-2 and 4-3 have been renumbered to 4-4 and 4-5.

22. Table 4-2 - Numbers specified for COCs other than PCBs are not correct. For example the frequency for collection of field duplicates is 1/20; with a total of 74 samples the number of field duplicates should be 4, not 2. Please check all numbers and revise accordingly.

Table 4-2 has been revised to indicate that 4 QC samples for COCs other than PCBs will be collected (at a frequency of 1 sample per 20 analyzed) and analyzed. All other numbers were checked. No other revisions were necessary.

23. Table 4-3 appears to include COCs that will not be analyzed during this project. This table should only include those analytes that are part of this project. Please revise accordingly.

Tables 4-3, 5-1 and 5-2 have been revised to include only COCs that are applicable to this project.

24. Table 5-1 - See previous comment.

Refer to comment 23 response.

25. Table 5-1, Note 3 - It is unclear if the analytes listed here are COCs at this site. If so, there is no discussion in the QA/QC portion regarding the use of the data as it relates to these analytes with regard to the project action limits versus the project quantitation limits.

Since the contracted laboratory does not have a problem achieving the stated detection limits for compounds listed and / or they are not constituents of concern, the subject in Note 3 of Table 5-1 is irrelevant and has been removed from the table.

26. Table 5-2 - See Comment 23, above.

Refer to comment 23 response.

27. Table 5-4 - EPA does suggest that field instruments be checked at more frequent intervals than proposed here. For example, P&W may check the calibration of the pH meter initially, followed by checks during and at the end of the day.

Table 5-4 has been revised to clarify the intent that more frequent intervals of calibration of field equipment will be performed. Additionally, the table has been updated to reflect only field equipment that is applicable to this project.

28. Table 5-5 shows precision/accuracy for the field pH measurements of ±1 pH S.U. These allowances appear to be substantial for pH; a more reasonable number would be ±0.1 pH S.U.

Table 5-5 has been revised to exhibit ±0.01 pH S.U. for accuracy and precision of the pH meter.

<u>*May 31, 2001 Response to EPA March Comments*</u>

29. With regards to P&W's response to K.T. General Comment 1 - regardless of the public notice that P&W has undertaken to satisfy the state requirements, it is my understanding that EPA will also require formal public notification on this site.

P&W is in the process of working with EPA toward a formal public notification for this project. A draft statement of basis for the project was submitted to the EPA RCRA Corrective Action Group on August 17, 2001. Formal Public notification will follow.

30. K.T. Specific Comment 16 - As stated in comment 7, above it is my understanding that all PCB-impacted materials meet the definition of "PCB remediation waste." If P&W has documentation to support otherwise, it should be submitted for EPA's review. Regardless, P&W may still request disposal of PCB-impacted material at < 50ppm in a state permitted hazardous and/or non-hazardous waste landfill. EPA still requests that specific disposal information regarding each waste stream be included in the RAWP.

Refer to comment 7 response.

31. K.T. Specific Comment 20 - In its response, P&W indicates that the RAWP was revised to provide for a 4-point composite sample representing 1,600 square-foot area. As in EPA's original comment, P&W provides no justification for this approach. Justification is required that would support this type of sampling scheme. Reference to the *Verification Sampling Guidance Manual* is not sufficient. This document was to support EPA's PCB Spill Cleanup Policy which is not applicable at this site.

A review of the contaminant distribution and the sediment depths and stratification observed during characterization investigations has been performed. Based on this data, and the previous EPA comments, the RAWP has been revised to provide a justification for the proposed sampling grid in each area of the site.

32. K.T. Specific Comment 26 - See comment 30.

Refer to comment 7 response.

33. K.T. Specific Comment 27 - P&W's response includes reference to 3540C or 3541 as extraction methods for this project. This is inconsistent with the information provided in Table 4-1. EPA does suggest that 3550 may not be a sound method for sediments due to the high organic content of the materials which could lower the PCB extraction efficiency for this method.

Table 4-1 has been revised to include specific extraction methods for each analytical method and each type of matrix.

In response to this comment, we have elected to use EPA Method 3545 (Pressurized Fluid Extraction) using the Dionex Accelerated Solvent Extractor (ASE) Model 300 apparatus.

July 13, 2001 Response to CTDEP

34. Attachment 1 includes a revised Table 4.1. The methods listed should include references for all matrices of interest, including soils, sediments, water, and concrete.

Table 4-1 has been revised to include the method references for each matrix.

35. Revised Table 4.1 also appears to contain errors in the referenced methods. For example 3510C is a separatory funnel liquid-liquid extraction procedure, which does not appear to be applicable to soils and sediments. Method 352C0 does not exist to EPA's knowledge.

Refer to comment 33 response.

July 26, 2001 Response to CTDEP

36. Confirmatory sampling within the wetland areas appear to have changed such that the grid sampling is comprising a larger area. As discussed in previous correspondence, EPA is concerned over the # samples/area given the heterogeneity of the PCB distribution in this area. Accordingly, unless P&W can provide a sound justification for its sampling scheme, this sampling approach (grid size/sample) is not acceptable in the wetlands and a smaller sampling spatially will be required.

Refer to comment 31 response. In addition, in response to DEP comment regarding the verification of remediation in the wetland area, the approach to sampling has been revised to provide for the collection and analysis of individual grab samples at a rate of one sample per 400 square feet rather than 4-point composite samples as specified for 25-ppm remediation areas. This approach is being implemented in the wetland area as no cap will be installed following remediation and the concentrations of PCBs to remain following remediation must comply with the residential Direct Exposure Criteria specified in the RSR. The RSR does not allow for composite sampling to determine compliance with the Direct Exposure Criteria. A complete description of the sampling approach for the project is provided in Section 4.2 of the

RAWP.

37. Table 5-1 contains TPH methods for both ETPH and 418.1. CTDEP indicated that ETPH was the method of preference. Accordingly, Method 418.1 should be eliminated from the Table unless P&W is still conducting this test.

Subsequent to the July 26, 2001 response to DEP comments, the DEP has been contacted regarding the use of 418.1 for analysis of TPH. In that conversation, it was agreed upon that the EPA-approved 418.1 method could be used for this project as it is still and approved method of determining compliance with the RSR. As a result of that conversation, method 418.1 has been selected for analysis of TPH. Table 5-1 has been revised to reflect the 418.1 method only and the text has been revised accordingly to eliminate references to ETPH methods.

<u>*General Overall Comments*</u>

38. The revised submittals appear to include additional procedures for on-site air monitoring both during work and idle time. The procedures address total dust and PM-10 dust. As the driver at the site is PCB-contaminated materials, P&W should provide a justification that the proposed air monitoring is sufficient and procedures for PCB monitoring is not necessary during this project.

This justification is included as Attachment No.2. Based on this most conservative modeling, the action level for dust is 10 times more conservative than the action level for PCBs at the maximum allowable dust concentration in air for the project.

39. A revised Dust Control Plan dated May 2001 was submitted. Normally, the 150 $\mu g/m^3$ standard is over a 24-hour period. Page 1-1 of the plan indicated that it is a time-weighted average over a single 1-hour period. Please clarify this difference with a justification to support this standard.

Based on the proposed dust control measures, (i.e. covering stockpiles during off hours, chemical and hydraulic control measures on exposed soil and disturbed areas), we expect little, if any, dust during the non-working hours. As such, using a 24-hour time weighted average (TWA) instead of the proposed 1-hour TWA would significantly "dilute" the results during the working hours and provide a much less conservative approach. Consequently, using a 24-hour time-weighted average instead of the more restrictive 1-hour time-weighted average with the action level of 150 ug/m^3 would theoretically reduce the instances in which active dust suppression activities would have to be implemented as a result of the relatively lower dust generation rates during the non-working hours. In addition, the hourly TWA yields real-time data over the previous hour, so that corrective measures may be immediately implemented. As such, the use of a one-hour time-weighted average versus the 24-hour time weighted average is justified as it provides for an additional level of protection against unacceptable exposures during working hours at the site.

40. The RAWP did not indicate a thorough understanding of the concept of data quality objectives (DQOs), Data Quality Indicators (DQIs) the and measurement performance

criteria (MPC), as discussed in the *EPA-NE QAPP Manual Sections 7.1 and 7.2*. DQOs are qualitative and quantitative statements that specify the quality of the data required to support decisions made during the project. For example, the 2 main objectives that are not included here may be:

a. The generation of high quality data that is necessary to support a final risk-based decision at the site; and

b. The generation of data sufficient to insure that initial project action limits are met.

The ability to generate data to meet DQOs is evaluated through the process of identifying the data quality indicators (DQIs...formerly referred to as PARCCS parameters) to be evaluated, setting MPC for each of the DQIs, and defining the QC samples to be collected to assess whether or not the MPC are met. Then, a sampling process design is developed and both sampling and analytical procedures are chosen that will support achieving the defined PQOs and assessing the MPC. It is unclear if the MPCs that have been specified in Tables 5.2 and 5.3 achieve that goal. The MPCs set for the DQIs are not defined by the standard laboratory methodologies. The MPCs must be set initially, and then both sampling and laboratory methods are selected (from existing methodologies, after modifying existing methodologies, or after developing new procedures) capable of meeting (or providing more stringent criteria than) the MPCs. P&W should review all protocols, methodologies, and criteria to insure that the overall goals for this project can/will be met.

P&W believes they have a very clear understanding of Data Quality Objectives (DQOs), Data Quality Indicators (DQIs) and Measurement Performance Criteria (MPCs) as it relates to this project and that all relevant references to DQOs, DQIs and MPCs are present within the current text. DQOs are detailed in section 5.1.2 "Objectives of the Quality Assurance Project Plan," section 5.1.3 "Remedial Action Data Quality Objectives, and section 5.3 "Quality Assurance Objective for Measurement Data."

Although P&W believes that this point has been made in the above referenced sections, the DQOs as stated in comment 40a and 40b have been added to the QAPP. Data Quality Indicators (DQIs) previously referred to as PARCCS Parameters are defined in sections 5.3.6 through 5.3.10. All previous references to PARCCS Parameters have been revised to DQIs to comply with the current language in Sections 7.2 of the EPA-NE QAPP Manual. The types of quality control samples that will be used to assess the DQIs and Measurement Performance Indicators (MPCs) area also defined in sections 5.3.6 through 5.3.10. Section 5.11 "Data Assessment Procedures" describes MPCs. It should be noted that since all confirmatory soil samples will undergo Tier II validation, criteria for MPCs, precision, accuracy/bias, representativeness, completeness, sensitivity, quantitation limits, and comparability will be assessed in accordance with the criteria specified in Region I, EPA-NE Functional Guidelines for Data Validation.

41. Instead of multiple revisions, it will be extremely helpful to receive a final document containing all the changes made to date. The latest revision to the RAWP should reflect the latest date when it was revised; all documents still have the original 11/20/00 date at the bottom of every page.

The attached revised RAWP is complete and includes all of the edits in responses to all comments received to date.

We hope that the above responses and the attached revised RAWP adequately address your comments and meets with your satisfaction. Should you have any further questions or comments, please do not hesitate to contact Lauren Levine of UTC at (860) 728-6520 or me.

Sincerely

LOUREIRO ENGINEERING ASSOCIATES, INC.

Brian A. Cutler, P.E., L.E.P.
Vice President

Attachments

cc: Lauren Levine, UTC
Elsie Patton, DEP, w/o enclosure and attachments
Richard Hathaway, DEP
Lori Saliby, DEP, w/o enclosure and attachments
Melissa Toni, DEP, w/o enclosure and attachments
Cori Rose, ACOE, w/o enclosure and attachments
Ernest Waterman, U.S. EPA, w/o enclosure and attachments

Attachment No. 1

Standard Operating Procedures

SOP ID 10006 Soil Sampling
SOP ID 10011 Geoprobe Probing and Sampling
SOP ID 10015 Geologic Logging of Unconsolidated Sedimentary Materials

Standard Operating Procedure
for
Soil Sampling

SOP ID: 10006
Date Initiated: 2/20/90
Revision #004: 6/19/97

Approved By: ______________________ 6-19-97
Name 1 **Date**

Gail T. Batchelder 6/19/97
Name 2 **Date**

LEA

LOUREIRO ENGINEERING ASSOCIATES

Standard Operating Procedure
for
Soil Sampling

1. Statement of Purpose

This document discusses procedures for collection of soil samples for analytical analysis. Methods for collection and quality assurance/quality control requirements are covered under separate SOPs. The procedures outlined in this document are in accordance with ASTM Standard D 420 and the EPA document Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW-846). These procedures may vary slightly according to the needs of specific projects.

2. Equipment and Equipment Documentation

2.1. Equipment required for the collection of soil samples shall include:

- Stainless steel spatula
- Distilled water
- Hand towels
- Polyethylene plastic sheeting
- Sample collection jars
- Clean disposable gloves
- Field documentation
- Indelible marker
- Cooler, cold packs and maximum/minimum thermometer
- Custody seals and sample labels
- Polythethylene plastic sheeting (5-mil thickness)

2.2 Cleaning and Decontamination

2.2.1 Prior to collecting a soil sample, the LEA representative will ensure that all necessary sampling equipment is clean and decontaminated according to the site-specific work plan or collection method SOPs.

2.2.2 Upon completion of all sampling requirements and prior to leaving the site, all equipment used for sampling shall be cleaned and decontaminated. All generated decontamination fluids shall be disposed of in accordance with the site-specific work plan and all municipal, state, and federal requirements.

3.0 Sampling Protocols

3.1 Preliminary Sampling Procedures

3.1.1 Sample Bottles

3.1.1.1 A Laboratory Request Form shall be completed and submitted to the laboratory with following information:

- Project name
- LEA commission number
- Date of submittal and date needed
- Quantity of sample locations and sample points at each location
- Type(s) of samples
- Analytes, detection limits and QA/QC needed
- Cooler(s) required
- Number of Chain-of-Custody forms requested

3.1.1.2 Check bottles against Laboratory Request Form for completeness. The bottles should also be checked for damage and cleanliness. Confirm with laboratory personnel the adequacy of the preservatives used.

3.1.1.3 Label all bottles prior to sampling with the information and check for accuracy. This step may also be performed in the field prior to sample collection.

3.1.1.4 The total number of sample sets shall be increased by 10% to allow for possible breakage during transport to sites or other contingencies (minimum: one additional sample bottle set per event).

3.1.1.5 A cooler with adequate ice or cold packs should be obtained from the laboratory to insure that the collected samples remain at 4°C during transport. Packing material should also be obtained to insure against breakage during transport.

3.1.2 Site Preparation

3.1.2.1 A level table shall be placed within the exclusion zone and covered with polyethylene sheeting.

3.1.2.2 Decontaminated spatulas shall be placed on the table. Prelabeled sample bottles shall be placed in a convenient location and in order of sample collection.

3.2 Sampling Procedures

3.2.1 All personal protective equipment (PPE) should be donned and maintained in accordance with the site-specific work plan or health and safety plan during all sampling procedures. In the event that no PPE has been specified for a particular sampling event, disposable latex gloves should be donned, as a minimum, during all sampling procedures.

3.2.2 The particular soil sampling device (i.e. hand auger, split spoon, etc.) shall be retrieved from the point of collection and placed on a level table covered in polyethylene sheeting.

3.2.3 Using a decontaminated stainless steel spatula, the soil shall be transferred directly into prelabeled soil sampling containers. Care should be taken to completely fill the sample container intended for VOC analysis. Large void spaces within the container shall be minimized by packing, <u>not</u> agitation.

3.2.4 Wipe the rim of the sample container with a clean paper towel to remove excess solids which would prevent adequate sealing of the sample container and seal the container.

The order of sample collection shall be as follows:

- samples to be analyzed for voltile organic compounds at the LEA Analytical Laboratory
- samples to be analyzed for volatile organic compounds using appropriate EPA methodologies
- samples to be screened for total volatile organic compounds with a total volatile organic analyzer
- samples to be analyzed for other organic and inorganic constituents

3.2.5 As required, affix a custody seal, noting the date and time of collection across the cap/bottle interface and on the sample label. Place and secure sample within cooler and complete all sample collection documentation.

3.3 Post-Sampling Procedures

3.3.1 As required, upon completion of all sampling procedures for a particular site, secure the lid of the cooler using packaging tape with the Chain-Of-Custody inside.

3.3.2 Should the laboratory be local, transport the samples directly to the laboratory and present them to the sample manager. The representative of LEA should witness the verification of the Chain-Of-Custody and obtain a carbon copy for filing in the project notebook.

3.3.3 Should the laboratory be distant, arrange for transport with a reputable carrier service. The cooler and samples shall be secured for transport, and all mailing documentation secured onto the top of the cooler. Unless otherwise specified, delivery shall be overnight. A request for confirmation of acceptance should be made to the carrier at the time of pick-up.

3.4 Documentation

3.4.1 The following general information shall be recorded in the field log book and/or on the appropriate field forms:

- Project and site identification
- LEA commission number
- Field personnel
- Name of recorder
- Identification of borings
- Collection method
- Date and time of collection.
- Types of sample containers used, sample identification numbers and QA/QC sample identification
- Preservative(s) used
- Parameters requested for analysis
- Field analysis method(s)
- Field observations on sampling event
- Name of collector
- Climatic conditions, including air temperature
- Internal temperature of field and shipping (refrigerated) containers
- Chronological events of the day
- Status of total production
- Record of non-productive time
- QA/QC data

3.4.2 The following information shall be recorded on the Field Quality Review Checklist:

- Reviewer's name, date, and LEA commission number
- Review of all necessary site activities and field forms
- Statement of corrective actions for deficiencies

3.4.3 The following information shall be recorded on the chain-of-custody record:

- Client's name and location
- Boring or sampling location identification
- Date and time of collection
- Sample number
- Container type, number, size
- Preservative used
- Signature of collector
- Signatures of persons involved in the chain of possession
- Analyses to be performed
- Type and number of samples

3.4.4 The following information shall be provided on the sample label using an indelible pen:

- Sample identification number
- Date and time of collection
- Place of collection
- Parameter(s) requested (if space permits)

3.4.5 The following information shall be recorded on the sample collection data sheet:

- Client name, location and LEA commission number
- Boring or sampling location identification number
- Date and time of collection
- Sample number
- Depth sample was obtained
- Field instrumentation reading

Standard Operating Procedure
for
Geoprobe® Probing and Sampling

SOP ID: 10011
Date Initiated: 11/10/94
Revision #003: 06/17/97

Approved By:________________ 6-17-97
Name 1 **Date**

Gail S. Batchelder 6/17/97
Name 2 **Date**

LEA

LOUREIRO ENGINEERING ASSOCIATES

Standard Operating Procedure for Geoprobe® Probing and Sampling

1. Statement of Purpose

The objective of this procedure is to collect a discrete soil sample at depth using Geoprobe® probing and sampling methodologies and to recover the sample for visual inspection and/or chemical analysis. Procedures for soil sampling for chemical analysis are included in *Standard Operating Procedures for Soil Sampling.*

2. Background

2.1. Definitions

Geoprobe® *: A vehicle-mounted, hydraulically-powered, soil probing machine that utilizes static force and percussion to advance small diameter sampling tools into the subsurface for collecting soil core, soil gas, or groundwater samples.

* (Geoprobe is a registered trademark of Kejr Engineering, Inc., Salina, Kansas.)

Large Bore Sampler: A 24-inch long x 1-3/8-inch diameter piston-type soil sampler capable of recovering a discrete sample that measures up to 320 ml in volume, in the form of a 22-inch x 1-1/16-inch core contained inside a removable liner.

Liner: A 24-inch long x 1-1/8-inch diameter removable/replaceable, thin-walled tube inserted inside the Large Bore Sampler body for the purpose of containing and storing soil samples. Liner materials include brass, stainless steel, Teflon®, and clear plastic (either PETG or cellulose acetate butyrate).

2.2. Discussion

In this procedure, the assembled Large Bore Sampler is connected to the leading end of a Geoprobe® brand probe rod and driven into the subsurface using a Geoprobe® machine. Additional probe rods are connected in succession to advance the sampler to depth. The sampler remains sealed (closed) by a piston tip as it is being driven. The piston is held in place by a reverse-threaded stop-pin at the trailing end of the sampler. When the sampler tip has reached the top of the desired sampling interval, a series of extension rods, sufficient to reach depth, are coupled together and lowered down the inside diameter of the probe rods. The extension rods are then rotated clock-wise (using a handle). The male threads on the leading end of the extension rods engage the female threads on the top end of the stop-pin, and the pin is removed. After the extension rods and stop-pin have been removed, the tool string is advanced an additional 24 inches. The piston is displaced inside the sampler body by the soil as the sample is cut. To recover the sample, the sampler is recovered from the hole and the liner containing the soil sample is removed.

3. Required Equipment

The following equipment is required to recover soil core samples using the Geoprobe® Large Bore Sampler and driving system. Sample liners for the Large Bore Sampler are available in four different materials. Liner materials should be selected based on sampling purpose, analytical parameters, and data quality objectives.

Large Bore Sampler Parts	Part Number
STD Piston Stop-pin, O-ring	AT-63, 63R
LB Cutting Shoe	AT-660
LB Drive Head	AT-661
LB Sample Tube	AT-662
LB Piston Tip	AT-663
LB Piston Rod	AT-664
LB Clear Plastic Liner	AT-665
LB Brass Liner	AT-666
LB Stainless Steel Liner	AT-667
LB Teflon® Liner	AT-668
LB Cutting Shoe Wrench	AT-669
Vinyl End Caps	AT-641
Teflon® Tape	AT-640T

Geoprobe® Tools	Part Number
Probe Rod (3 foot)	AT-10B
Probe Rod (2 foot)	AT-10B
Probe Rod (1 foot)	AT-10B

Drive Cap	AT-11B
Pull Cap	AT-12B
Extension Rod	AT-67
Extension Rod Coupler	AT-68
Extension Rod Handle	AT-69
Optional	**Part Number**
LB Manual Extruder	AT-659K
Extension Rod Jig	GS-469
LB Pre-Probe	AT-146B
Additional Tools	
Vise Grips	
Open Ended Wrench (3/8-inch)	
1-inch or Adjustable Wrench	

4. Procedures

4.1. Utilities Clearance

4.1.1. Notify the appropriate "one call" utility notification service (e.g. Call Before You Dig) at least three working days prior to commencing operations on a site. The locations of all proposed borings must be clearly marked in the field prior to notification.

4.1.2. Particularly upon larger private sites, consult with the owner or other person knowledgeable about the site as to locations of potential private or abandoned utilities and locate these prior to beginning work. Upon the discretion of the project manager, a pipe locator can also be used to assist in locating utilities.

4.1.3. Note that OSHA may have additional requirements for location of utilities.

4.1.4. All efforts to locate underground utilities should be properly documented in the field log book prior to onset of the work scheduled.

4.2. OSHA

The foreman or supervisor of the drilling crew shall be the Competent Person as required by OSHA for all of their work. However, this does not relieve the LEA representative from bringing to his or her attention conditions which may be unsafe or present a hazard to the drilling crew, the general public, or other workers on the site. The LEA representative is responsible for ensuring that LEA activities are conducted in accordance with the site-specific Health and Safety Plan.

4.3. Site Preparation

4.3.1. A sufficient area shall be cordoned off to restrict access to the work area. This area shall be termed an "Exclusion Zone".

4.3.2. An equipment decontamination area shall be assembled as described in Section 4.11 within the exclusion zone.

4.3.3. The area immediately surrounding the proposed borehole and the back portion of the rig (including the tires) shall be covered with 5 mil plastic sheeting. A hole of sufficient diameter shall be cut from the center of the plastic sheeting to facilitate auger advancement.

4.3.4. All personal protective equipment shall donned.

4.4. Assembly

4.4.1. Install a new AT-63R)-ring into the O-ring groove on the AT-63 Stop-pin.

4.4.2. Seat the pre-flared end of the LB Liner (AT-665, -666, -667, or -668) over the interior end of the AT-660 Cutting Shoe. It should fit snugly.

4.4.3. Insert the liner into either end of the AT-662 Sample Tube and screw the cutting shoe and liner into place. If excessive resistance is encountered during this task, it may be necessary to use the AT-669 LB Shoe Wrench. Place the wrench on the ground and position the sampler assembly with the shoe end down so that the recessed notch on the cutting shoe aligns with the pin in the socket of the wrench. Push down on the sample tube while turning it, until the cutting shoe is threaded tightly into place.

4.4.4. Screw the AT-664 Piston Rod into the AT-663 Piston Tip. Insert the piston tip and rod into the sample tube from the end opposite the cutting shoe. Push and rotate the rod until the tip is seated completely into the cutting shoe.

4.4.5. Screw the AT-661 Drive Head onto the top end of the sample tube, aligning the piston rod through the center bore.

4.4.6. Screw the reverse-threaded AT-63 Stop-pin in the top of the drive head and turn it **counter-clockwise** with a 3/8-inch wrench until tight. Hold the drive head in place with a 1-inch or adjustable wrench while completing this task to assure that the drive head stays completely seated. The assembly is now complete.

4.5. Pilot Hole

A pilot hole is appropriate when the surface to be penetrated contains gravel, asphalt, hard sands, or rubble. Pre-probing can prevent unnecessary wear on the sampling tools. A Large Bore Pre-Probe (AT-146B) may be used for this purpose. The pilot hole should be made only to a depth above the sampling interval. Where surface pavements are present, a hole may be drilled with the Geoprobe® using a Drill Steel (AT-32, -33, -34, or -35, depending upon the thickness of the pavement), tipped with a 1.5-inch diameter Carbide Drill Bit (AT-36) prior to probing. For pavements in excess of 6 inches, the use of compressed air to remove cuttings is recommended.

4.6. Driving

4.6.1. Attach an AT-106B 1-foot Probe Rod to the assembled sampler and an AT-11B Drive Cap to the probe rod. Position the assembly for driving into the subsurface.

4.6.2. Drive the assembly into the subsurface until the drive head of the LB sample tube is just above the ground surface.

4.6.3. Remove the drive cap and the 1-foot probe rod. Secure the drive head with a 1-inch or adjustable wrench and re-tighten the stop-pin with a 3/8-inch wrench.

4.6.4. Attach an AT-105B 2-foot Probe Rod and a drive cap, and continue to drive the sampler into the ground. Attach AT-10B 3-foot Probe Rods in succession until the leading end of the sampler reaches the top of the desired sampling interval.

4.7. Preparing to Sample

4.7.1. When sampling depth has been reached, position the Geoprobe® machine away from the top of the probe rod to allow room to work.

4.7.2. Insert an AT-67 Extension Rod down the inside diameter of the probe rods. Hold onto it and place an AT-68 Extension Rod Coupler on the top threads of the extension rod (the down-hole end of the leading extension rod should remain uncovered). Attach another extension rod to the coupler and lower the jointed rods down-hole.

4.7.3. Couple additional extension rods together in the same fashion as in Step 2. Use the same number of extension rods as there are probe rods in the ground. The leading extension rod must reach the stop-pin at the top of the sampler assembly. When coupling extension rods together, you may opt to use the GW-469 Extension Rod Jig to hold the down-hole extension rods while adding additional rods.

4.7.4. When the leading extension rod has reached the stop-pin down-hole, attach the AT-69 Extension Rod Handle to the top extension rod.

4.7.5. Turn the handle **clockwise** (right-handed) until the stop-pin detaches from the threads on the drive head. Pull up lightly on the extension rods during this procedure to check thread engagement.

4.7.6. Remove the extension rods and uncouple the sections as each joint is pulled from the hole. The Extension Rod Jig may be used to hold the rod couplers in place as the top extension rods are removed.

4.7.7. The stop-pin should be attached to the bottom of the last extension rod upon removal. Inspect it for damage. Once the stop-pin has been removed, the sampler is ready to be re-driven to collect a sample.

4.8. Sample Collection

4.8.1. Reposition the Geoprobe® machine over the probe rods, adding an additional probe rod to the tool string if necessary. Make a mark on the probe rod 24 inches above the ground surface (this is the distance the tool string will be advanced).

4.8.2. Attach a drive cap to the probe rod and drive the tool string and sampler another 24 inches. Use of the Geoprobe®'s hammer function during sample collection may increase the sample recovery in certain formations. Do not over-drive the sampler.

4.9. Retrieval

4.9.1. Remove the drive cap on the top probe rod and attach an AT-12B Pull Cap. Lower the probe shell and close the hammer latch over the pull ap.

4.9.2. With the Geoprobe® foot firmly on the ground, pull the tool string out of the hole. Stop when the top (drive head) of the sampler is about 12 inches above the ground surface.

4.9.3. Because the piston tip and rod have been displaced inside the sample tube, the piston rod now extends into the 2-foot probe rod section. In loose soils, the 2-foot probe rod and sampler may be recovered as one piece by using the foot control to lift the sampler the remaining distance out of the hole.

4.9.4. If excessive resistance is encountered while attempting to lift the sampler and probe rod out of the hole using the foot control, unscrew the drive head from the sampler and remove it with the probe rod, the piston rod. and the piston tip. Replace the drive head onto the sampler and attach a pull cap to it. Lower the probe shell and close the hammer latch over the pull cap and pull the sampler the remaining distance out of the hole with the probe machine foot firmly on the ground.

4.10. Sample Recovery

4.10.1. Detach the 2-foot probe rod if it has not been done previously.

4.10.2. Unscrew the cutting shoe using the AT-669 LB Cutting Shoe Wrench, if necessary. Pull the cutting shoe out with the liner attached. If the liner doesn't slide out readily with the cutting shoe, take off the drive head and push down on the side wall of the liner. The liner and sample should slide out easily.

4.11. Core Liner Capping

4.11.1. The ends of the liners can be capped off using the AT-641 Vinyl End Cap for further storage or transportation. A black end cap should be used at the bottom (down end) of the sample core and a red end cap at the top (up end) of the core.

4.11.2. On brass, stainless steel, and Teflon® liners, cover the end of the sample tube with AT-640T Teflon® Tape before placing the end caps on the liner. The tape should be smoothed out and pressed over the end of the soil core so as to minimize headspace. However, care should be taken not to stretch and, therefore, thin the Teflon® tape.

4.12. Sample Removal

4.12.1. Large Bore Clear Plastic and Teflon® Liners can be slit open easily with a utility knife for the samples to be analyzed or placed in appropriate containers.

4.12.2. Large Bore Brass and Stainless Steel liners separate into four 6-inch sections. The AT-659K Large Bore Manual Extruder may be used to push the soil cores out of the liner sections for analysis or for transfer to other containers.

4.12.3. The procedures for collection of soil samples for chemical analysis are described in the *Standard Operating Procedure for Soil Sampling*.

4.12.4. Soil samples collected for archive purposes shall be placed into 4-ounce clear soil jars and labeled with boring numbers, depth, and commission number.

4.13. Equipment Decontamination and Cleaning

4.13.1. Prior to conducting a boring, the LEA representative will ensure that all necessary equipment is clean and decontaminated, including the rig, all augers and probing equipment, samplers, brushes, and any other tools or equipment. Decontamination procedures may vary slightly from those presented below, dependent upon the particular types of contaminants encountered.

4.13.2. A section of 5-mil (minimum) plastic sheeting shall be cut of sufficient size to underlie the decontamination area to contain any discharge of decontamination solutions.

4.13.3. The following solutions (as appropriate for the anticipated contaminants) shall be prepared and placed in 500-ml laboratory squirt bottles: methanol solution (less than 10%); 10% nitric acid solution; 100% hexane solution; and distilled deionized (DI) water. A fifth solution of phosphate-free detergent and tap water (approximately 2.5 gallons) shall be prepared in a five-gallon bucket. Only those solutions required for site-specific conditions will be used at a given site, as specified in the site-specific work plan.

4.13.4. All loose debris shall be removed from the augers and spatulas into an empty 5-gallon bucket or plastic sheeting using a stiff bristled brush.

4.13.5. The order of decontamination solutions is as follows:

1) Detergent Scrub
2) DI Water Rinse
3) Hexane Rinse (to be used only if separate-phase petroleum product, other than gasoline, is present)
4) DI Water Rinse
5) 10% Nitric Acid Rinse (to be used only when metals are suspected as potential contaminants)
6) DI Water Rinse
7) Methanol Rinse (<10% solution)
8) Air Dry

4.13.6. Each piece of decontaminated sampling equipment will be wrapped in aluminum foil to maintain cleanliness.

4.13.7. An alternative to the procedure described above requires that the larger equipment be cleaned using a high-pressure wash and steam cleaning in an area constructed to contain spent decontamination fluid and debris (plastic sheeting bermed with timber is usually sufficient). Alternative methods of cleaning may be more appropriate for an individual piece of equipment for site conditions based upon a knowledge of site contaminants, and may be used at the discretion of the LEA representative. Section 5.4 provides additional information on management of potentially contaminated fluids and materials.

4.13.8. At the end of the project day, all used equipment shall be decontaminated. All spent decontamination solutions will be handled and disposed of in accordance with all applicable municipal, state and federal regulations.

4.14. VOC Monitoring

4.14.1. A portable volatile organic compound (VOC) analyzer shall be available on site and shall be used to screen all cuttings and fluids (if any) removed from the hole.

4.14.2. Since, in general, it cannot be presumed that there is no contamination at a given site, all cuttings and/or fluids which show a reading on the VOC analyzer that is above background shall be containerized or drummed, as appropriate, on site. Additional information on management of potentially contaminated fluids and materials is presented in Section 5.4.

5. Sample Collection and Documentation

5.1. Sample collection following removal from borehole.

5.1.1. The sample tube shall be opened by the LEA representative and immediately scanned using the VOC analyzer using the approach described in Section 5.2.

5.1.2. The LEA representative will record on the boring log at a minimum: description of the material in the sampler, depth, VOC analyzer reading, material size gradation using the Burmeister system, color, moisture, and relative density.

5.1.3. Prior to reuse, the sampler shall be decontaminated using the procedures described in Section 4.13.

5.1.4. Soil samples collected for archival purposes shall be placed into 4-ounce clear soil jars and labeled with the boring number, depth, and commission number.

5.1.5. The procedures for collection of soil samples for chemical analysis are described in the *Standard Operating Procedure for Soil Sampling*.

5.2. Field Analysis

5.2.1. The following procedure shall be used to obtain readings of the VOCs present in a soil sample:

1) Obtain an aliquot of soil (approximately 50 grams) from the split spoon and placed into a Ziploc™ plastic bag or equivalent and sealed.
2) Agitate the sample, assuring that all soil aggregates are broken, for two minutes.
3) Carefully break the seal of the bag enough to insert the VOC probe.
4) Record the maximum reading obtained on the appropriate forms, as described in Section 5.3.

5.3. Field Documentation

5.3.1. The following general information shall be recorded in the field log book and /or appropriate field forms:

- Project and site identification
- LEA commission number
- Field personnel
- Name of recorder
- Identification of borings
- Collection method
- Date and time of collection
- Types of sample containers used, sample identification numbers and QA/QC sample identification
- Field analysis method(s)
- Field observations on sampling event
- Name of collector
- Climatic conditions, including air temperature
- Chronological events of the day
- Status of total production
- Record of non-productive time
- QA/QC data
- Name of drilling firm
- Location of boring(s) on site insufficient detail to relocate boring at a future time (include sketch)

5.3.2. The following information shall be recorded on the boring log:

- Project name, location, and LEA commission number
- Borehole number, borehole diameter, boring location, drilling method, contractor, groundwater observations, logger's name and date
- Depth below grade, sample I.D. number, duplicate numbers, VOC analyzer reading, rig behavior (i.e. drilling effort, etc.)
- A complete sample description, including as a minimum: depth, material size gradation using the Burmeister system, color, moisture, and density. Should a well be constructed in a borehole, a complete well schematic shall be drawn and accurately labeled
- Use of water, including source(s) and quantity

5.3.3. The following information shall be recorded on the Field Quality Review Checklist:

- Reviewer's name, date, and LEA commission number
- Review of all necessary site activities and field forms
- Statement of corrective actions for deficiencies

5.3.4. The Field Instrument & Quality Assurance Record shall include the following information:

- Client's name, location, LEA commission number, date
- Instrument make, model, and type
- Calibration readings
- Calibration/filtration lot numbers
- Field personnel and signature

5.4. Disposal of Potentially Contaminated Materials

Potentially contaminated cuttings or fluids, as indicated by knowledge of the site, discoloration, VOC analyzer readings, or other evidence, shall be containerized on- site pending sampling and determination of hazardous waste status.

5.5. Refusal

Refusal is defined as failure to penetrate the subsurface materials to any greater depth using the maximum reasonable pressure limits of the Geoprobe® machine.

5.6. Bedrock

The term "bedrock" will not be used in a boring log or other description of subsurface materials that have been collected using the Geoprobe® machine, since a confirmational core cannot be collected.

5.7. Boring Abandonment

5.7.1. If the boring is not to be used for other purposes (i.e. monitoring well, soil vapor probe, soil vapor extraction well, etc.) it shall be abandoned.

5.7.2. The boring shall be filled and sealed with neat cement grout or high density bentonite clay grout as soon as the tools are withdrawn from the borehole.

5.7.3. Excess cuttings shall be containerized and sampled before disposal.

5.7.4. In paved areas, the upper three feet of the borehole shall be filled, up to two inches below the existing grade, with sand to allow for repairing of the pavement.

5.7.5. Pavement shall be repaired using cold patch asphalt filler or concrete.

6. Other

Depending on the specific site, other considerations may be applicable. Consult the OSHA regulations, applicable RCRA or CERCLA regulations, and the site-specific work plan for details.

7. References

Geoprobe® Systems, August 1993, "1993-04 Equipment and Tools Catalog".

Standard Operating Procedure
for
Geologic Logging of Unconsolidated Sedimentary Materials

SOP ID: 10015
Date Initiated: 12/27/94
Revision #001: 11/20/96

Approved By:

______________________ 11/20/96
Name 1 **Date**

Gail T. Batchelder 11/20/96
Name 2 **Date**

LEA

Standard Operating Procedure for Geologic Logging of Unconsolidated Sedimentary Materials

1. Statement of Purpose

This document presents the methods and procedures used to describe unconsolidated sedimentary materials for geological purposes in a uniform and consistent manner. It includes procedures for properly recording the observations by providing guidelines for completing boring logs and submitting those logs for computer entry. This Standard Operating Procedure (SOP) refers only to geologic logging of soils and sediments (including artificial fill and other man-made deposits) and specifically is not intended to describe logging of soils or sediments for geotechnical or other engineering purposes. Although the SOP presents a system for describing sediments, it is not intended to be a definitive reference for classifying sedimentary materials, nor is it intended to replace experience or training. Individuals using this SOP should be trained and competent in field methodologies and geologic logging prior to commencing field activities.

2. Collection of Unconsolidated Soil/Sediment Samples

2.1. Equipment required for the geologic logging of soil/sediment samples shall include the following items:

- Tape measure or scale
- Hand lens
- Color chart
- Grain-size comparator
- Field forms
- Indelible marker(s)
- Small table
- Field Book
- Clipboard

2.2. Sample Collection

Samples of soil and unconsolidated sedimentary materials will be collected in general accordance with the SOPs for Soil Sampling (SOP #10006), Hand Auger Borings (SOP #10003), Hollow Stem Auger Soil Borings (SOP #10008), and Geoprobe® Probing and Sampling (SOP #10011). Those SOPs include procedures for decontamination of equipment required for sample collection, as well as providing the methodologies for sample collection and documentation.

3. Descriptions of Unconsolidated Sedimentary Materials

3.1. General Sediment Description Guidelines

For the purposes of geologically logging unconsolidated soils and sedimentary materials, a Modified Burmister method of description and classification should be used. The Modified Burmister Sediment Classification System (or simply, Burmister System) is intended as a rapid field method for identifying and classifying sediments. The system is based upon visual identification of the generalized grain-size distribution and description of the physical characteristics of the sample.

A Burmister System description is comprised of three parts: a color descriptor; a grain-size descriptor; and modifier(s).

The color descriptor indicates the overall color or colors of the wet sample. The descriptor consists of a color name or names and (if possible) the color code from a standard color reference (for example, a Munsell[7] Color Chart).

The grain-size description indicates the predominant grain size in the sample, as well as the relative percentages of other grain sizes present.

Modifiers are used to further describe the geologic character of the sample. Modifiers may include descriptions of moisture content, sorting, sphericity, angularity, sedimentary structures or other pertinent information.

3.1.1. Color Description

The color of the wet sediment should be determined with reference to a standard color comparator (for example, a Munsell[7] Color Chart) for rocks or sediment. The included color descriptor should contain both the color name and, when a color comparator is used, the appropriate hue-chroma value code, for example "Reddish brown (5YR 4/4)". The color of a sample should always be gauged when the sample is wet, or it should be noted otherwise.

3.1.2. Predominant Grain-Size Description

The first step in describing a sediment sample is visually estimating the size range and percentage of the various grain sizes in the sample.

Reference should be made to standard geologic comparators for assessment of the grain size(s).

The primary grain-size descriptor indicates the predominant grain size, as judged visually, of the sample. The descriptor is always capitalized and underlined. Possible descriptors include: CLAY, SILT, SAND, GRAVEL (GRANULES, PEBBLES, COBBLES, and BOULDERS). These correspond to the standard Wentworth size-classification scheme used for describing sediments for geologic purposes. Size classifications for CLAY through GRAVEL are presented in Table 1. The descriptor should also include an indication of the relative size range of the sample within the predominant grain size (for example, "fine-to-medium sand", "coarse sand", etc.). Although Table 1 includes divisions of the silt category, this is applicable only to sediment samples analyzed by pipette or hydrometer and cannot be distinguished in the field.

The presence of other grain sizes, in addition to the predominant material is also included in the grain-size descriptor. Appropriate grain sizes are the same as for the predominant grain size of the material (clay, silt, etc.), however only the initial letter of the word is capitalized. The description should also include an indication of the relative amount of the minor components. Appropriate indicators for the relative percentages present are provided in Table 2.

It is generally not considered possible to visually distinguish between clay and silt. Estimation of the silt/clay content of a sample should be based upon the plastic properties of the sample. The plastic properties of the sample may be estimated by taking an approximately 1 cubic centimeter ball of the sediment and attempting to roll a thread of the material between the palms of the hand. The minimum size of the thread which may be rolled may be compared to the values presented in Table 3 and the plasticity estimated. A comparison of the minimum thread diameter which may be formed with the information presented in Table 3 provides an approximate silt/clay content estimate for sand-silt-clay sediments and composite clay sediments.

3.1.3. Modifiers

Various modifiers may be added to the basic sediment description to further describe the geologic character of the sample.

For sand or coarser-sized material, the relative degree of sorting, the sphericity, and angularity should also be recorded. Sorting may be visually estimated. Sphericity and angularity, however, should be made with reference to an accepted comparator. A chart illustrating various degrees of sphericity and angularity is attached as Figure 1.

The mineralogy of the sample should also be recorded. Reference should be made to the relative percentages, grain size(s), and sphericity of the mineral particles (especially where it differs significantly from that of the predominant grain-size material).

Other information which should be recorded for each sample includes an estimate of the density and cohesiveness of the sample (made from blow counts where applicable, or other specific instrumentation where appropriate), the relative moisture content of the sample, visible sedimentary structures, and any odors or staining noticeable during logging. Tables 3 and 4 present appropriate terms for describing the plasticity, density, and cohesiveness of sediment samples.

Especially important is an indication that a specific portion of the material may represent "sluff" or material collapsed from the borehole walls.

3.2. Written Sediment Descriptions

The written sediment description may be made as either an unabbreviated or an abbreviated description. Both methods should relate the same information, however the abbreviated description is better suited for field use.

In an unabbreviated description, all of the words of the description should be written out in their entirety. The descriptor should include pertinent information regarding the sample's size gradation, consistency, color, and relative grain size, as described previously. The color descriptor should precede the primary sediment component name, while additional details such as the plasticity, mineralogy, visible sedimentary structures, etc., should follow the sediment component name.

An example of an unabbreviated description is:

Red-brown (5YR 4/4), fine to coarse SAND, little fine Gravel, little Silt, moist, moderately well sorted, low

sphericity, Gravel waterworn, Sand subangular, micaceous.

Since the Burmister system is intended to provide a means for describing uniform sediments, three "special" cases should be addressed.

First, the Burmister system is intended only to describe the sediment. Where a genetic classification of the material is significant, it should be added as a separate statement at the end of the description. For example:

> **Olive gray (5Y 4/2), coarse to fine SAND, some fine Gravel, little Silt, moist, poorly sorted, sub-rounded to angular, dense. TILL.**

A genetic classification should only be used when the origin of the material is very clear and not simply a field interpretation of possible depositional environment.

Second, in the case where the sediment sample is heterogeneous (for example, a varved silt and clay), each component should be described individually, and reference should be made to the relative percentages of each component and to the interlayering. For example:

> **Soft, reddish-brown (5YR 3/4), CLAY and SILT, alternately layered, medium to high overall plasticity. Layers: CLAY layers, 3/8" to 5/8" thick, comprise 60%" of sample. SILT layers, 1/8" to 3/8" thick, comprise 40%" of sample. VARVED CLAY and SILT.**

Third, when one material grades uniformly into a distinct sediment type, the individual components should be described separately and the gradation noted. For example:

> **Soft, reddish-brown (5YR 3/4), CLAY, medium overall plasticity, grading into soft, reddish-brown (5YR 4/4), SILT, trace Clay, low overall plasticity.**

In the abbreviated sediment descriptions, the sample information is presented in a manner analogous to that for the unabbreviated description substituting standard abbreviations for specific portions of the text. Abbreviations for the identifying terms in the Burmister system are presented in Tables 2, 3, and 4. Mineralogic and geologic abbreviations may be found in standard geologic and mineralogic texts and field manuals. Except for the use of abbreviations, the abbreviated description is completely analogous to the unabbreviated description.

For the sake of consistency in describing unconsolidated sedimentary materials, the description should follow the order and general definitions presented in Table 5.

4. Recording Descriptions

4.1. Geologic Boring Logs

Attached to this SOP is a copy of LEA's standard geologic boring log form. This log should be completed for each boring that is completed. The heading information is self-explanatory. The body of the log contains space for information for each sampled interval in the boring. The following information should be recorded:

Depth Interval	The upper and lower depths from which the sample was collected.
Sample No.	The sample number, as obtained from LEA Data Management, assigned to this sample.
Recovery	The length of the recovered sample and the length of the sampler (in consistent units). The percent recovery will be calculated by the geologic logging program.
Blows/6"	The number of blow counts per 6" interval for the sample. Alternately, the downhole pressure or other pertinent information regarding the required drilling or sampling force.
Sample Description	The sample description using the guidelines and order presented in Section 3.0 and Table 5.
PID/FID	The headspace reading from a PID or FID in ppm.

The comments section of the form should be used to record general observations regarding drilling conditions, backfilling of the borehole, or other pertinent information regarding drilling the borehole.

4.2. Computer Data Entry

After a project is completed, copies of the Geologic Boring Log forms should be submitted for computer data entry. A completed copy of the Geologic Soil Boring/well Completion Log Request Form should be attached to the log forms; a copy of the request form is attached to this SOP.

TABLE 1
Wentworth Size Classification System

US Standard Sieve Sizes	Millimeters	Microns	Phi (N)	Wentworth Size Classification	
Use Wire Squares	4096	4,096,000	-20	Boulder	GRAVEL
	1024	1,024,000	-10		
	256	256,000	-8		
				Cobble	
	64	64,000	-6		
				Pebble	
	16	16,000	-4		
5	4	4,000	-2		
				Granule	
6	3.36	3,360	-1.75		
7	2.83	2,830	-1.50		
8	2.38	2,380	-1.25		
10	2.0	2,000	-1.00		
				Very Coarse Sand	SAND
12	1.68	1,680	-0.75		
14	1.41	1,410	-0.50		
16	1.19	1,190	-0.25		
18	1.00	1,000	0.00		
				Coarse Sand	
20					

	0.84	840	0.25	
25				
	0.71	710	0.50	
30				
	0.59	590	0.75	
35				
	0.50	500	1.00	
				Medium Sand
40				
	0.42	420	1.25	
45				
	0.35	350	1.50	
50				
	0.30	300	1.75	
60				
	0.25	250	2.00	
				Fine Sand
70				
	0.210	210	2.25	
80				
	0.177	177	2.50	
100				
	0.149	149	2.75	
120				
	0.125	125	3.00	
				Very Fine Sand
140				
	0.105	105	3.25	
170				
	0.088	88	3.50	
200				
	0.074	74	3.75	
230				
	0.0625	62.5	4.00	

				Coarse Silt	MUD
270	0.053	53	4.25		
325	0.044	44	4.50		
Analyzed by Pipette or Hydrometer	0.037	37	4.75		
	0.031	31	5.0		
				Medium Silt	
	0.0156	15.6	6.0		
				Fine Silt	
	0.0078	7.8	7.0		
				Very Fine Silt	
	0.0039	3.9	8.0		
				Clay (Note: Some use 2: (or 9N) as the clay boundary.)	
	0.0020	2.0	9.0		
	0.00098	0.98	10.0		
	0.00049	0.49	11.0		
	0.00024	0.24	12.0		
	0.00012	0.12	13.0		
	0.00006	0.06	14.0		

Table 2
Modified Burmister System Descriptors

Fractions		Proportion Descriptors		
(+)	Major Fraction	Quantity	Descriptor	Abbreviation
(-)	Minor Fraction	35% - 50%	and	a
e.g., a medium to coarse SAND which is predominantly medium grained would be written as: m(+) - c SAND		20% - 35%	some	s
		10% - 20%	little	l
		1% - 10%	trace	t
		Modifiers: **(+) Upper** a of the range **(-) Lower** a of the range		

Table 3
Plasticity of Sediment Samples

Material	Symbol	Feel	Ease of Rolling Thread	Minimum Thread Diameter	Plasticity Index	Plasticity
Clayey SILT	CyM	Rough	Difficult	1/4"	1 to 5	Slight (Sl)
SILT & CLAY	M & C	Rough	Less Difficult	1/8"	5 to 10	Low (L)
CLAY & SILT	C & M	Smooth, dull	Readily	1/16"	10 to 20	Medium (M)
Silty CLAY	MyC	"Shiny"	Easy	1/32"	20 to 40	High (H)
CLAY	C	Waxy, very shiny	Easy	1/64"	40 +	Very High (VH)

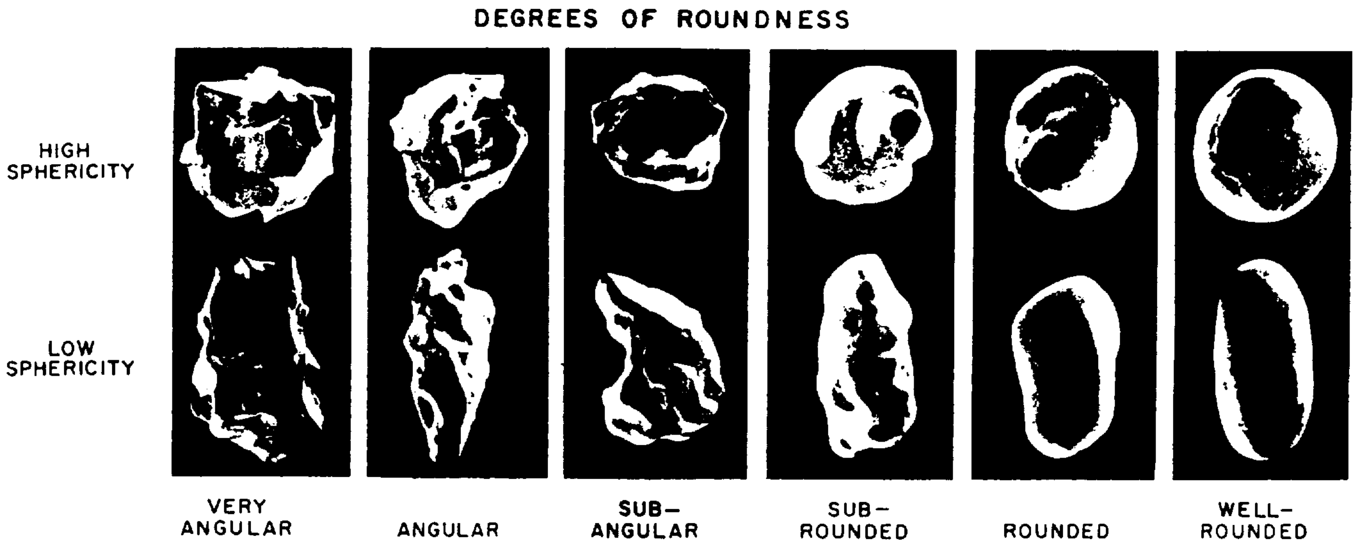
Table 4
Density and Cohesiveness of Sediment Samples

Density of Cohesionless Soils		Consistency of Cohesive Soils	
Blow Counts	Relative Density	Blow Counts	Consistency
0 to 4	Very Loose	0 to 2	Very Soft
5 to 9	Loose	2 to 4	Soft
10 to 29	Medium Dense	4 to 8	Medium
30 to 49	Dense	8 to 15	Stiff
50 to 79	Very Dense	15 to 30	Very Stiff
80 or more	Extremely Dense	30 or more	Hard

Table 5
Description of Sediment Properties

Sediment Parameter	Properties
Color	The color of the sample should be described for the wet sediments. If possible the color should be referenced to a standard color chart such as a Munsell7 Color Chart.
Primary Grain Size	Primary grain size refers to the size of the predominant sedimentary size class within the material (as judged visually). The grain size divisions should conform to the standard Wentworth Scale divisions, as shown in Table 1.
Secondary Grain Size(s)	Secondary grain size(s) refer to material which, as a grain-size group, comprises less than the majority of the sediment. Aside from stating the size classification, the relative percentage of the material must be stated. The grain size divisions should conform to the standard Wentworth Scale divisions as shown in Table 1. To describe the approximate percentage of the secondary grain size(s) present, qualifiers shown in Table 2 should be used.
Moisture Content	The moisture content of the sample should be described as dry, slightly moist, moist, or wet. Gradation from one state to another should be recorded as, for example, moist to wet, or moist ÿ wet.
Sorting	The relative degree of sorting of the sediment should be indicated as poor, moderate, good, or very good. The degree of sorting is a function of the number of grain size classes present in the sample; the greater the number of classes present the poorer the sorting. In addition, for samples composed only of sand, the relative degree of sorting is a function of the number of sand-size subclasses present.
Sphericity	Sphericity is a measure of how well the individual grains, on average, approximate a sphere. The average sphericity of the sand and larger size fractions should be described as low, moderate or high. A chart illustrating various degrees of sphericity is presented in Figure 1.
Angularity	Angularity, or roundness, refers to the sharpness of the edges and corners of a grain (or the majority of the grains). Five degrees of angularity are shown in Figure 1: Angular (sharp edges and corners, little evidence of wear); Subangular (edges and corners rounded, faces untouched by wear); Subrounded (edges and corners rounded to smooth curves, original faces show some areas of wear); Rounded (edges and corners rounded to broad curves, original faces worn away); and, Well Rounded (no original edges, faces, or curves, no flat surfaces remain on grains).
Sedimentary Structures	Sedimentary structures are such things as varved layers, distinct bedding, or stratification.
Density -or- Cohesiveness	The density of cohesion of a sample (for the purposes of this application) refer to the sample's resistance to penetration by a sampling device. Density is used in reference to sediments primarily silt-size and coarser while cohesiveness is used in reference to primarily clay-sized sediments. Density or cohesiveness can be assessed from the number of blows from "standard" split-spoon sampling (i.e., 140# hammer, 30" fall, 2" X 2" (O.D., 1 3/8" I.D.)) split-spoon samplers according to the scale in Table 3.

FIGURE 1

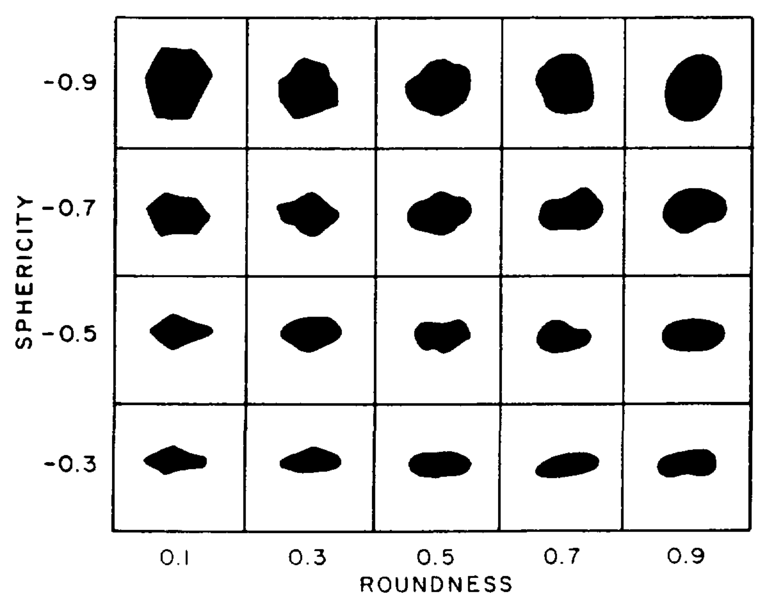


SPHERICITY

0.3 LOW
0.5 & 0.7 MODERATE
0.9 HIGH

ROUNDNESS

0.1 ANGULAR
0.3 SUBANGULAR
0.5 SUBROUNDED
0.7 ROUNDED
0.9 WELL ROUNDED



Attachment No. 2

Rationale for Dust Monitoring Action Level

Loureiro Engineering Associates, Inc.

Interoffice Memo

Date: 8/23/01
To: George Andrews
From: Dick Twomey
Subject: UTC P&W Willow Brook, LEA-LCI Reponse to May 2001 RAWP Comments

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Comment 38

Air Monitoring is sufficient to monitor respirable dust based upon the following:

- The particulate (dust) monitoring instrument used is an MIE DataRam model PDR 1000 set up to automatically monitor 10-micron (respirable size) particulate at 10-minute intervals.

- Site particulate monitoring is being done continuously in an active downwind work area location.

- The instrument location is selected daily to obtain the worst case concentration of particulate on the job site. Selecting an instrument location downwind of an active work area provides the maximum contaminant in air concentration.

- The monitor provides maximum and time-weighted average (TWA) airborne concentrations. The TWA is logged in a book hourly by the site Health and Safety Officer.

- This type instrument is used to get real-time monitoring of dust particulate, so that we can react quickly to control dust if levels exceed a conservative action-level of 150 Φg/m^3.

- The OSHA 8-hour TWA for respirable dust is 5 mg/m^3 or 5,000 Φg/m^3. The LEA-LCI action limit is 150 Φg/m^3. This provides a respirable dust safety factor of 5,000/150 = 33.3.

Air Monitoring to monitor the PCB exposure is based upon the following model:

- Our contaminant concentration model assumes that the concentration of PCB's in the air equals the maximum concentration characterized in the soil. The calculations for this model are listed as follows:

  – Maximum concentration of PCB's in soil = 650 parts per million = 0.065% = 0.00065.

  – At the particulate action limit of 150 Φg/m^3, PCB's = 0.065% = 0.0975 Φg/m^3.

- The most restrictive standard is the NIOSH REL = 0.001 mg/m^3 = 1Φg/m^3.

- Using this standard, the safety factor for PCB's when particulate levels are at 150 Φg/m3 is calculated as follows:

  – Safety factor = 1Φg/m^3/0.0975Φg/m^3 = 10